NTIA Spectrum News

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Office of Spectrum Management

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WRC-2000: Preparing for the Future

A major international treaty conference, the World Radiocomunications Conference, WRC-2000, of the International Telecommunication Union (ITU) will be held in Istanbul, Turkey from May 8 - June 2. Over 100 administrations are expected to participate with as many as 2500 delegates attending. The agenda consists of over 20 important items, and nations have been intensively preparing for two and a half years. This issue of the NTIA Spectrum News addresses some of the important issues.

Issues related to the replanning of the broadcasting satellite spectrum in ITU Regions 1 (Europe and Africa) and 3 (Asia) appear to be particularly contentious. Many countries in Regions 1 and 3 support replanning at WRC-2000, and they support specific plans developed within an inter-sessional group. However, other countries, predominantly European, want WRC-2000 to deal only with the basis for planning at a future conference, and they do not support the results of the planning effort.

With respect to public communications, an agenda item for IMT-2000 promises to draw a great deal of interest. The important issue is identifying additional spectrum for 3rd generation wireless. European studies have focused on the 2500-2690 MHz band, but many countries have identified other spectrum, indicating that they have not yet made a decision, or concluded that they do not yet need additional spectrum at this time. Portions of this agenda item are discussed in separate articles for IMT-2000 and the 2700-2900 MHz band.

WRC-97 debated issues regarding sharing between non-geostationary and geostationary fixed-satellite services, resulting in the compromise adoption of provisional power-flux-density limits. The ITU-R Joint Task Group 4-9-11 studied these sharing requirements, but an agreement was difficult until a breakthrough compromise was reached by concerned parties at the Conference

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Rohde Appointed to Head NTIA -Initiates Spectrum Innovation Project

As one of his first initiatives, Gregory L. Rohde, the newly appointed Assistant Secretary of Commerce for Communications and Information and head of NTIA, launched a new project on wireless communications that will enable the U.S. government to more actively promote innovation in the development and use of new communications technologies that, in turn, would improve the quality of life and expand business opportunities at home and abroad. The growing complexity of today's communications systems is challenging the private and public sectors. The Wireless Innovations in Communications Initiative deals with all forms of wireless communications providing a mechanism for senior government communications managers to meet with developers of communications technologies and determine how the U.S. government would benefit by the use of such technologies.

This initiative will also afford the Administration an opportunity to promote communications innovations which will, in turn, enable businesses to expand and individuals to improve their standards of living. The initiative encompasses the full range of wireless communications requirements and technologies, including fixed, mobile, radars, navigation, and satellites. Since demands for the spectrum are increasing rapidly, there is an urgent need to ensure that this limited resource is used in an effective and efficient manner.

Before being appointed by President Clinton to NTIA, Mr. Rohde served as a senior aide to Senator Byron L. Dorgan (D-North Dakota) for more than ten years as the chief policy advisor for all areas of jurisdiction under the Senate Committee on Commerce, Science, and Transportation, including telecommunications and technology issues. He played a key role in many important legislative initiatives such as the Telecommunications Act of 1996 and the Internet Tax Freedom Act of 1998 which provided a moratorium of state and local taxation on electronic commerce.

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Preparatory Meeting in November 1999. Since then, these concerned parties have been working on the detailed draft regulations that will support the compromise. A significant effort will also be required to clarify the compromise for those administrations that have not participated directly in the technical studies.

The very difficult discussions at WRC-97 regarding sharing between the mobile-satellite and radionavigation-satellite services, specifically the U.S. Global Positioning System (GPS) system (See NTIA Spectrum News, Volume 1) have grown into several issues concerning the radionavigation-satellite service. The most difficult issue is obtaining new spectrum to support the accuracy and redundancy needed for aviation precision landings. At issue will be the spectrum needed to upgrade GPS, providing sufficient spectrum for other systems such as the planned European Galileo system, and the minimization of impact to other radionavigation operations.

Consideration of spectrum for the fixed and fixed-satellite services around 40 GHz will continue at WRC-2000. Many administrations appear to be headed towards the setting of power flux densities (pfds) that encourage the use of high density fixed systems below 40 GHz and high density fixed-satellite systems above 40 GHz.

The scientific research community also has a significant interest in this conference. Specific science agenda items deal with allocations above 71 GHz (See article Above 71 GHz) and the Earth exploration-satellite (EES) service at 18.6-18.8 GHz. Most of the world's administrations now support the compromise limits on the fixed service and fixed-satellite service in the 18.6-18.8 GHz band. While these compromises will cause the EES operators to lose half their critical data, some administrations are still asking for less restrictive pfds for the fixed-satellite service.

WRC-2000 promises to be an exciting time. Many decisions will be made there that will impact the future communications of the world. See you in Istanbul.

IMT-2000

International Mobile Telecommunications-2000 (IMT-2000), also known as the Third Generation Mobile Systems, is the International Telecommunication Union's (ITU) vision of global access in the 21st Century. These systems will fulfill the dream of communications anytime and anywhere, providing both terrestrial and satellite access. IMT-2000 will offer a wide variety of broadband and multimedia communications capabilities, providing a new level of worldwide access to information for business, education, community services, safety and entertainment. Service is scheduled to begin this year in some countries, either in frequency bands previously identified by the World Administrative Radio Conference 1992 (WARC-92), or through an evolutionary process by operators wishing to implement third generation mobile systems in bands currently used for existing Cellular and Personal Communications Systems (PCS).

Beginning in the late 1980's, the ITU convened a special Task Group 8/1 to study the technologies and various spectrum related issues that would make the ITU's vision a reality. This proved to be a great challenge with various proposals and frequency ranges being considered. The group successfully completed its work by November 1999, developing the standards for the radio transmission technologies. Its report on the need for additional spectrum for IMT-2000 was submitted to the Conference Preparatory Meeting 1999 (CPM). Considering the increasingly mobile international society and the need to satisfy the many communications needs of the world, ITU-R Study Group 8 decided that it was necessary to continue work on IMT-2000 systems and beyond, and it established a new Working Party 8F to continue where TG 8/1 left off.

The WRC will be challenged to identify more spectrum in order to fully realize the IMT-2000 vision, and to meet the growing demand for mobile services. One approach that the WRC will likely take is to identify a limited number of contiguous bands available globally to reduce the cost, size and complexity of IMT-2000 terminal and network equipment and deployment, and to provide the economies of scale for the mass market.

The IMT-2000 spectrum needs have been a major topic of regional and sub-regional WRC proposals and views, and it appears that it will not be possible by WRC-2000 for many Administrations to identify the large amount of contiguous spectrum for near-term IMT-2000 use in a globally harmonized manner. The difficulties result when considering the huge investment in equipment currently operating in the desirable bands, band sharing problems, the impact on consumers and other users of existing services, and the lack flexibility to authorize other systems based on national needs.

Following extensive analyses and international talks, the United States has had difficulty identifying a single band that could likely be used on a global basis by IMT-2000 and other advanced communications technologies. Some administrations have proposed the 1710-1885 MHZ and 2500-2690 MHZ bands as candidates for regional or global use by IMT-2000 and other technologies. These bands present significant challenges for the United States because of important existing uses. However, recognizing the interest expressed in these bands by some Administrations and some members of industry, the United States will closely examine the possibility of some available spectrum in these bands. As a result, the United States has initiated a multi-step process to determine whether these bands, or any part thereof, are feasible for use domestically by IMT-2000 and other advanced communications technologies. The United States must consider the investment of existing licensees, the impact on consumers and other users of existing services, the flexibility to authorize other systems based on national needs, current and emerging uses, the availability of comparable replacement spectrum to which current and emerging uses might migrate, and the costs of relocation against the benefits of global harmonization of spectrum for IMT-2000 and other advanced communications technologies. The United States will not have completed this process in time for the WRC, but plans to resolve issues related to use of these bands in time for the next WRC.

Ambassador Gail Schoettler, Head of the U.S. Delegation to WRC, formed a U.S. negotiation team comprised of industry and government representatives and led by NTIA and the Federal Communications Commission. The goal of the team was to make the IMT-2000 future a reality. Despite the difficulties, the team, in an intense effort, was able to reach consensus on a proposal that identifies additional spectrum for use by IMT-2000 and other advanced communications technologies. The proposal considers that

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IMT-2000 and the 2700-2900 MHz Band

Developers of new telecommunications technology have not always been able to find room in the spectrum to accommodate their new services. In the past this problem has been solved by sharing bands already used by other similar services or by subdividing the existing bands and migrating the existing services to one of the new sub-bands. As the spectrum becomes more fully used, however, this has become less feasible, since both sharing between different services and concentrating operations of existing services in a portion of the allocated range may be very difficult to accomplish.

ASR-9 Radar.
Courtesy of Northrop Grumman.

A case in point is the 2700-2900 MHz band where developers have focused attention on the band as potentially suitable for 3rd Generation commercial mobile communications systems, including International Mobile Telecommunications-2000 (IMT-2000). The band is allocated, however, to the aeronautical radionavigation service on a primary basis and the radiolocation service on a secondary basis in the International Telecommunication Union's *Radio Regulations*. The *Radio Regulations* also authorize the band's use for meteorological purposes on a basis of equality with stations operating in the aeronautical radionavigation service. Aeronautical radionavigation service radar systems use the band extensively for critical air traffic control while radars operating for meteorological purposes use the band for critical weather observations. Use of these radars is quite extensive around the world and extensive technical analyses would be required to determine the feasibility of use by other radio services. Decisions regarding the possible identification of this band for IMT-2000 will be taken by the upcoming WRC-2000.

Aeronautical Radionavigation Service

Airport surveillance radars (ASR) are used by air traffic controllers at airports to manage aircraft both operating nearby and those landing and taking off. ASRs allow increased air traffic capacity by permitting controllers to reduce the separation between aircraft more than would otherwise be possible under visual control. The radars detect and display an aircraft's position up to a range of 110 kilometers, and the aircraft's identification is obtained through related systems operating in other bands. In the United States and many other countries, the safety of aircraft is dependent upon the operation of robust, reliable and high integrity radar systems to ensure that aircraft reach their destinations safely. Air traffic controllers rely on radar as their primary method of locating aircraft beyond visual ranges in all weather conditions. ASRs require very high powered transmitters with wide emission bandwidths that make it difficult for other systems to operate in large parts of the spectrum over a wide geographic area.

The 2700-2900 MHz band is used by thousands of ASRs throughout the world. For example, the ASR-11 model is used in many countries including Norway, The Netherlands, India, Oman, The People's Republic of China, Germany, Switzerland, Jamaica, Brazil, and Australia. Among the major manufacturers are Raytheon, Lockheed-Martin and Northrop Grumman in the United States, Alenia Marconi Systems in Italy and the United Kingdom, Siemens Plessey Systems in the United Kingdom, Elta Electronics Industries in Israel, NEC in Japan, and the China National Electronics Import and Export Corp. in China. Thus, the availability of radio spectrum in the 2700-2900 MHz band is vital to the aviation industry throughout the world to ensure that the public continues to enjoy safe and efficient air transport.

NTIA has a long involvement in spectrum management of radars in the 2700-2900 MHz band. Twenty years ago, the close proximity of airports in several areas of the United States lead to the requirement for many closely located ASRs. In Southern California, harmful interference occurred in many of the ASRs, causing delays in aircraft landings and departures. NTIA conducted extensive analyses and measurements in the band, and, after determining that frequency separation within the band could not eliminate the interference, took two steps. First, NTIA recommended the addition of a special circuit – a pulse repetition frequency (PRF) integrator – that eliminated the interference from radars that had different PRFs. This permitted more radars to operate in close proximity by eliminating pulsed interference, but would have no effect on continuous wave signals. Second, NTIA designated certain geographic areas as "Heavily used areas in the 2700-2900 MHz band." Radar systems operating the 2700-2900 MHz band in these areas require more stringent emission bandwidth and emission level standards than normal. Thus, every effort has already been made to optimize the spectrum efficiency of these systems.

Meteorological Radars

Ground based radars used for meteorological purposes operate in the 2700-2900 MHz band for long range detection of weather systems and forecasting. The most recent radar developed in this band in the United States is the sophisticated Next Generation Radar or NEXRAD. Planned enhancements to the NEXRAD should extend its service life to the year 2040.

The NEXRAD, known more formally as the WSR-88D (standing for Weather Surveillance Radar-1988 Doppler), much like the ATC radars, use special circuits to eliminate pulsed interference, but cannot eliminate continuous wave signals. The NEXRADs use Doppler radar technology to measure motion of clear air and atmospheric phenomena within storms up to a maximum distance of 230 kilometers. This technology allows much more accurate detection of circulations associated with tornadoes and other severe weather. The NEXRAD radar excels in detecting the severe weather events that threaten life and property. Its use in the United States has nearly tripled the lead-time for tornado warnings from 4 minutes to 11 minutes, and more than quintupled the lead-time for flash flood warnings from 10 minutes to 52 minutes, potentially saving many lives each year.

The NEXRAD is also the primary weather radar system used for flight planning activities and is often located at airports to provide accurate weather conditions for aircraft. One hundred and sixty-six NEXRAD systems have been installed in the United States. Furthermore, there are at least 320 meteorological radars operating in more than 52 countries throughout the world. Lockheed-Martin is the major manufacturer of the NEXRAD radar.

Current Policy Initiatives – WRC-2000

Sharing studies are underway in Study Group 8, which covers both mobile and radar issues. A U.S. study, submitted to the ITU-R Task Group 8/1 and using the methodology specified by the ITU-R, indicated that sharing

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many Administrations are studying, and will continue to study, the 698-960 MHz, 1710-1885 MHz, and 2500-2690 MHz bands or portions thereof to determine the possibility of sharing between existing systems and new advanced communications technologies, to assess the requirements and benefits of existing services, and to consider various means to facilitate global roaming. The results of these studies will be useful for administrations wishing to implement advanced communications technologies including IMT-2000. To preserve each Administration's flexibility to use these bands for other fixed and mobile systems as they may deem necessary to their national interest, particularly in light of the ongoing studies, this proposal clarifies the flexibility to use these bands within the broadly-defined service allocations in those bands.

The United States proposes the identification of spectrum in several bands for consideration by Administrations for the implementation of IMT-2000 and other advanced communications technologies. Specifically, the proposed modified S5.388 and Resolution IMT to identify the 698-960 MHz, 1525-1559 MHz, 1610-1660.5 MHz, 1710-2025 MHz, 2110-2200 MHz, 2483.5-2690 MHz bands for potential IMT-2000 use. The U.S. proposal acknowledges that many Administrations, including the United States, are studying some of the proposed spectrum to determine its feasibility within the national boundaries of that particular Administration. For that reason, the United States calls for the adoption of a second new Resolution addressing national studies as well as ITU-R studies related to the 698-960 MHz, 1710-1885 MHz and 2500-2690 MHz bands. The national studies will clarify if Administrations can make those bands available. ITU studies will look at aspects to facilitate the implementation of these new technologies.

Spectrum Management of Passive Radio Services Above 71 GHz

The radio spectrum is critical to many different radio services that provide functions including air traffic control, satellite communications, amateur radio operations, and passive services. Although the radio frequency spectrum is not a consumable resource, the use of a frequency at a given location usually prevents that frequency and others near it from being used by others in the same geographic area. This need for exclusive geographic use to preclude harmful interference has led to current spectrum regulations that establish exclusive use of the spectrum by granting licenses for spectrum use, and under certain conditions, providing shared use among radio services.

In some cases, passive (non-transmitting) services can share spectrum with active services where adequate geographic separation can be maintained, or the direction of transmission can be controlled to avoid emissions into the sensing receiver of the passive service.

While all radio services are important, spectrum managers need to continue to support the passive services used for critical scientific research that helps us understand our universe.

What are Passive Services?

Today, the passive services include Earth exploration-satellite (passive), radio astronomy, and space research (passive). Passive services are used to help us understand the total Earth system, the effects of natural and human induced changes to the global environment, and the characteristics of objects or phenomena in space.

Earth exploration and passive remote sensing are performed using passive techniques to probe the Earth's land, oceans, and atmosphere via satellites. These activities provide a wealth of information about the characteristics of the Earth's natural phenomena.

Radio astronomy is equally important to the research of the universe. Radio astronomy is the study of radio emissions of celestial objects by measurement and analysis of the electromagnetic radiation they emit in the wavelengths from 0.1 mm to 30m. The radio astronomy service uses extremely sensitive radio telescopes with large collecting surfaces, to probe the structure of the universe. Their size and sensitivity is vital because radio astronomy signals are extremely weak. Radio telescopes are usually located at remote locations or in space, far away from sources of man-made radio noise. Multi-satellite constellations transmitting from space to Earth can create difficulties for radio astronomers, and such potential problems must be considered to preclude serious interference.

Similarly, the space research service uses radio waves to probe the structure of the outer atmosphere of the Earth and of the near-Earth interplanetary environment. Passive space research services perform their functions without transmitting, using only the natural radio emissions of the atmosphere and space.

Above 71 GHz Issues at ITU WRC-2000

The current Table of Frequency Allocations in the ITU's Radio Regulations does not fully satisfy the spectrum needs of the passive services. Considerable progress has been made in the area of science research, and the current ITU allocation table needs to be modified to reflect current knowledge of natural phenomena.

WRC-97 recognized this need and began work on the allocations above 50 GHz for the science-related services. However, only the allocation of the portion of spectrum from 50-71 GHz was completed because many studies were not finished. As a result, Resolution 723 of WRC-97 decided to consider these allocations at the WRC-2000, this time in the region above 71 GHz. Therefore, WRC- 2000 Agenda Item 1.16 considers allocations of frequency bands above 71 GHz to the Earth exploration- satellite (passive), radio astronomy, and space research (passive) services.

Following the advice of the U.S. passive sensing community that coordinated its proposals with the remote sensing communities in many other nations, the formal U.S. proposal to WRC-2000 modifies many of the allocation tables above 71 GHz to satisfy the requirements of the earth-exploration satellite (passive), radio astronomy, and space research (passive) services, while considering the spectrum needs of other services. Efforts have been made to avoid allocation conflicts between passive services and other services that are naturally incompatible with passive services, either in the same band or in an adjacent band. The proposed modifications to the allocation table maintain the aggregate amount of spectrum allocated to the displaced services (including the fixed-satellite service); provide frequency blocks 5-9 GHz wide to accommodate future wideband multimedia systems while considering differences in atmospheric attenuation; and provide appropriate spectrum separation between services. The U.S. proposal also identifies the need for the future study of sharing between active services allocated in the same band, and between active and passive services at such a time when the technical characteristics of the active services become known.

WRC-2000 offers the opportunity to provide additional allocations to satisfy critical passive service spectrum needs while protecting existing allocations for future use. It will also safeguard the interests of other services allocated in this portion of spectrum. Reorganizing the allocations above 71 GHz will ensure that the spectrum can be successfully shared between passive and active services in that range.

Passive services are critical to our understanding of our universe, and the judicious reallocation of frequencies above 71 GHz will meet enable important research to move forward.

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2700-2900 MHz

was not feasible. It noted that sharing would create conflicts between important public-access communication systems and radars used for meteorological purposes and safety of life aeronautical radionavigation operations, which may not be possible to resolve. The study also indicated that radar data would be degraded. Moreover, it recognized that if the 2700-2900 MHz band is used as an expansion band for IMT-2000, it would probably be used primarily in areas of the highest population densities, exactly where the radar systems are the most critical.

Given the difficulties with sharing shown in the U.S. input to TG8/1, the use of the 2700-2900 MHz band for third generation, commercial mobile communication systems, such as IMT-2000, would require the transition of the existing radars to a new band. The 2700-2900 MHz band offers good radar performance and angular resolution with reasonable sized antennas. Radio waves in the band have the detection and propagation characteristics suitable for both air traffic control and weather forecasting and warning capabilities. The consequences of this WRC decision and any made about this band during subsequent ITU study programs could have far reaching and potentially negative consequences for radar use in the band.

The impact of relocating the radars would have both operational and cost effects. The unique detection and propagation characteristics afforded in the 2700-2900 MHz band could be lost with a move to another part of the spectrum. The range of the radars could be reduced, requiring the aeronautical and meteorological communities throughout the world to procure additional radars to fill in the gaps. The U.S. input to TG8/1 further indicated that even with additional radars, the radar detection capabilities would be adversely affected, with a resulting overall loss of accuracy used for both air traffic control and measurements in severe weather events.

Third generation systems, including IMT-2000, will likely have to share spectrum with existing systems and radio services due to spectrum scarcity. The needs of these new services cannot be allowed to adversely effect existing critical radio uses, such as radars for aeronautical radionavigation and meteorological purposes in the 2700-2900 MHz band. At WRC-2000, Administrations will decide on whether the 2700-2900 MHz band will be identified for IMT-2000 or continued to be pursued for the future. Selection of spectrum for new communications technologies can be much easier and more readily accomplished when spectrum choices incorporate more "sharing-friendly" bands where the new operations can be accommodated with the existing users.

Schoettler Heads U.S. WRC-2000 Delegation

Dr. Gail Schoettler has been appointed by President Clinton to lead the U.S. delegation to WRC -2000. Dr. Schoettler has the rank of Ambassador. Ambassador Schoettler will head a delegation of about 100 experts from the Federal government agencies and the private sector.

Ambassador Schoettler was previously Lt. Governor and two-term treasurer of the state of Colorado where she negotiated and solved some of Colorado's toughest problems, and was responsible for managing billions of dollars of state and pension funds. She has extensive experience in leading business delegations to Europe, Asia, Latin America and Africa. In the business arena, she started two successful banks and continues to help manage her family's cattle ranch, vineyards and real estate enterprises. She has a BA in economics from Stanford University and MA and PhD degrees in history from the University of California. Ambassador Schoettler has received numerous awards, including the Legion of Honor, France's highest civilian award, from French President Jacques Chirac.

Ambassador Schoettler has three vice chairmen of the delegation: Damon Ladson, Karl, Nebbia and Frank Williams. The spokespersons on the key agenda items and issues are:

BSS Issues - Kim Baum
Satellite Coordination Procedures - Doug Spalt
IMT-2000 - Damon Ladson and
Darlene Drazenovich
GPS/MSS - Jim Vorhies
High Density Fixed Service - Cecily Holiday
and Karthryn Medley
Above 71 GHz - John Zuzek
Earth Exploration Satellite - Wayne Whyte
NGSO FSS. - Julie Garcia

If you have questions or concerns, please contact any of these spokespersons directly while at the WRC-2000.

NTIA and USTTI HOLD 18th SPECTRUM MANAGEMENT SEMINAR

The National Telecommunications and Information Administration (NTIA) and the United States Telecommunications Training Institute (USTTI) held the 18th annual seminar on radio spectrum management March 20-31 in Washington, DC. The seminar was conducted for leading regulators and communications professionals by NTIA's Office of Spectrum Management with assistance from experts from Comsearch and Motorola. It addressed various elements of spectrum management principles, engineering analyses, and computer-aided spectrum management techniques. In the last 18 years, NTIA has trained 390 individuals from 106 countries in radio spectrum management.

"Economic growth and the resulting improvement in the quality of life worldwide are highly dependent on modern telecommunications infrastructures in which good spectrum management plays a key role," said Gregory L. Rohde, Assistant Secretary of Commerce for Communications and Information and administrator of NTIA. "These new telecommunications technologies pose many challenges to spectrum managers," he said. "Our training seminar is designed to help the participants meet those challenges and help their countries move forward into the 21st century," Rohde added.

The USTTI presented diplomas to 14 graduates at a dinner held on March 30. Graduating were Ronald Kennedy of Barbados, Sylvester Cadette of Dominca, Henry Kanor and Patrick John Laryea of Ghana, Linus Thomas of Grenada, Ilham Ghazi and Sana Zairi of Morocco, Ali Akbar Detho of Pakistan, John King of Papua

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18th Management Seminar

New Guinea, Teresita Cataluna of the Philippines, Rathnayake M.T.K.P. Livera and Ymauna Nayani Karunajeewa of Sri Lanka, Apollo Knights of St. Vincent and Grenadines, and Kwibisa Wambulawae of Zambia. Special guest at the dinner was Robert "Bob" Mayher, Chairman of ITU-R Study Group 1.

The USTTI, a non-profit industry-government joint venture, was launched in 1982 at the International Telecommunication Union (ITU) Plenipotentiary Conference in Nairobi, Kenya, by Ambassador Michael R. Gardner, who was then Chairman of the U.S. delegation. It was formed to address the compelling need of developing nations for technical and managerial training in telecommunications and broadcasting. Since 1982, the USTTI has provided 936 training courses, all tuition-free, and has graduated over 5,000 telecommunications officials from 161 developing countries. The USTTI is a non-profit corporation and relies entirely upon the corporate support of Board Members for its operating expenses. The U.S. Department of State and the U.S. Agency for International Development provide travel and per diem scholarship funds for participants from the neediest developing countries.

SPOTLIGHT ON: The People's Republic of China

China, abundant with rivers and mountains so magnificent, uncounted national heroes all bow to its beauty. Such magnificence is also seen in the tremendous growth of the Chinese economy in the last decade of the20th century. From a country whose radio regulations were managed by the military prior to 1987, China's spectrum management organization has grown in leaps and bounds in recent years. The State Radio Regulatory Commission (SRRC) for the civil sector was established in 1987, comprising a very small executive office staff. As the economy rapidly developed following reforms and "openness" policies, so did the radio regulatory organization. In 1990, the SRRC formed strong employee teams consisting of radio communication engineers, computer engineers and programmers, lawyers, and other experts. The SRRC established new facilities and adopted modern computer systems for spectrum management, spectrum monitoring and direction finding.

China established two technical bodies in 1990 to provide technical support for the SRRC: the National Radio Spectrum Management Center and the National Radio Spectrum Monitoring Center. In 1990, the U.S. National Telecommunications and Information Administration (NTIA) conducted spectrum management seminars with the new radio regulatory team. In 1993, the SRRC published the first administrative regulation governing "Radio Regulations of the People's Republic of China" - a major milestone for the spectrum management legal system.

From 1996, after moving office locations, the SRRC completed the foundation for their spectrum management program. A province-level database system was established, linking every local office in nearly all the provinces. Each province had its own database records for the transmitters in their districts, and using this system the SRRC managed automated licensing and requirements. Although China was active previously, the SRRC intensified Chinese participation in the International Telecommunication Union (ITU), and in other international and regional telecommunication organizations.

In the new spectrum management program, China began international satellite coordination and established new frequency planning policy and equipment type-approval procedures. Technical analyses, spectrum efficiency, and interference analyses were tools used for frequency assignments. Spectrum monitoring and direct finding systems helped to establish a new way for detecting and managing the order of airwaves and solving interference problems.

Following the reorganization of the Ministry of Information Industry (MII) in 1998, the outstanding new leader of the SRRC, Mr. Liu Lihua, reorganized the SRRC and the two centers. The SRRC was renamed the Radio Regulatory Department (RRD) of the Ministry. The RRD consists of five divisions: the Space Service Division; the Supervision and Inspection Division; the Frequency Planning Division; the Terrestrial Service Division; and the Comprehensive Administrative Division.

Both the Terrestrial and Space Divisions are responsible for processing frequency assignment applications, coordination with other countries, and other provinces within service scope respectively. The Frequency Planning Division is responsible for frequency allotment planning and radio transmission equipment type-approval. The Supervision and Inspection Division is responsible for radio regulation law and resolving interference problems.

The two technical centers were reorganized into one larger office to simplify administrative procedures and improve efficiency, but the two centers retain their names. The office provides technical support to the RRD on spectrum management issues. It performs spectrum-related engineering research, interference analyses, spectrum management software development, database maintenance, daily spectrum monitoring, equipment testing for type-approval, and some administrative work like radio station and frequency licensing and charging of fees.

At the outset of the new millennium, the People's Republic of China is moving forward on spectrum management developments, as its government recognizes the importance of spectrum management, especially following the rapid development of wireless communications. A few of its major goals are: 1) establish a national monitoring station network for terrestrial and satellite systems using the advanced monitoring facilities; 2) establish an advanced electromagnetic compatibility (EMC) analysis laboratory including a simulation system for sharing and interference analysis; 3) develop a software system for computation of interference and coordination using digital mapping; and 4) develop an Oracle-based centralized database system interconnecting every province in China.

You are invited to visit the Radio Regulatory Department's Website, if you read Chinese, to learn more about spectrum management policies and rules: www.srrc.cn.net. If you can't read Chinese, be on the lookout for an English version of the Website in the near future.

A bright future is ahead for spectrum management in China!

The *"Where Are They Now?"* feature appearing in the last issue proved to be very popular. It will resume in the

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